

SPACE INVESTIGATIONS: THEIR EFFECT ON SCIENCE AND TECHNOLOGY

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(NASA-TT-F-15525) SPACE INVESTIGATIONS:
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(Scientific Translation Service) 44 P HC
\$4.00 7 CSCL 05B

N74-22589

G3/34 Unclass
36699

Translation of "Kosmicheskiye issledovaniya:
vliyaniye na nauku i tekhniku"; Aviatsiya
i kosmonavtika, No. 1, 1974, pp. 36 - 37.



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546 APRIL 1974

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The image of the first artificial satellite in the world, /36*
that of the Soviet Union, decorated the emblem of the XXIV International Astronautics Congress, held in Baku 8-13 October, 1973. It was held under the slogan, "Space Investigations: Their Effect on Science and Technology". The Congress assembled nearly 1500 participants from 29 countries. At its different sessions 350 reports were heard. A significant contribution to the work of the Congress was made by Soviet scientists. Our delegation, headed by Academician L. Sedov, numbered more than 200 people. Pilot-Cosmonauts of the USSR V. Shatalov, G. Beregovaya, V. Sevast'yanov, B. Yegorov and the American Astronaut T. Stafford participated in the Congress.

This was the first International Astronautics Federation Congress held in our country. The greeting message of the Council of Ministers of the USSR to the participants and guests of the Congress states: "In our day, when significant, positive changes are taking place in the international situation, scientists are finding unfolded before them more favorable possibilities for expanding scientific ties, exchanging experience, and using scientific achievements for the practical needs of mankind".

The organizer of the International Astronautics Congresses is the International Astronautics Federation (IAF), which is an

* Numbers in margin indicate pagination in original foreign text.

association of national scientific societies. It was created in 1950. Today, the Federation numbers 57 societies from 36 countries.

The basic goals of the IAF are cooperation for the development of astronautics for peaceful purposes, broad dissemination of technical information, expansion of interest in spaceflights by the aid of mass propaganda, calling congresses and scientific conferences, cooperation with other organizations in work relating to all aspects of astronautics, and the peaceful use of space.

In 1960, the International Academy of Astronautics and the International Institute of Space Law were created in the IAF.

IAF President Luigi G. Napolitano stated at the Congress:

"The International Astronautics Federation is happy to be a guest of the Soviet Union, which has done so much to improve the lives of men, and which has made such an important contribution to the investigation and peaceful use of space — from the pioneering works of Tsiolkovski and the flight of the first cosmonaut, Yuriy Gagarin, to the remarkable scientific and technical achievements of today".

At the many sections, symposia and colloquia of the Congress, various problems of astronautics and space investigations were discussed. Among these were problems relating to the creation of an international orbital station and space transport, rescue in space, the design of spacecraft, and decreasing the cost of space investigations. A large place was occupied by problems of bio-astronautics. A symposium was held on extra-terrestrial civilizations. Problems of space law were discussed. The Congress also gave its attention to such problems as safety in young peoples' experiments in rocket technology.

There were many interesting reports and meetings of journalists with the scientists.

The results of space investigations are finding ever more broad and varied practical application with each passing year. Penetration into space has exerted a powerful effect on modern man's perception of the world. He has ceased to feel himself limited by the confines of our planet. In going into space, people have gained the capacity to look at the Earth from aside, as it were.

The development of the unlimited capacities of science and technology in mastering the forces of nature doubtlessly had a favorable influence on the sense of responsibility for the fate of our entire planet, a sense of responsibility which has strengthened in recent years.

As the result of their global nature, space investigations to a significant degree make possible the development of international scientific and technical cooperation, a unification of the world's peoples. One of the manifestations of this cooperation is the preparation for the joint flight of the "Soyuz" and "Apollo" spacecraft, to be held in 1975.

The development of astronautics required great efforts from man as well as enormous material expenditures. Being principally the result of scientific-technical progress, space investigations now of themselves exert an ever-growing powerful influence on accelerating the tempo of development of science and technology, enriching them with new ideas, and have a powerful effect in the most varied fields of the daily lives of people.

The achievements of the Soviet Union in this field were characterized in the report of the President of the Academy of Sciences of the USSR, M. Keldysh; the report was read at the Congress by the Vice President of the IAF, Academician L. Sedov.

In connection with the requirements of space technology, dozens of new types of metal and non-metallic building materials have been created. These include stably weldable alloys based on titanium, nickel, copper, molybdenum and aluminum, special high quality steels, incombustible, heat-resistant, acid-resistant and anti-corrosive materials and coverings, non-gassing, high-temperature electrical insulating materials and sealing gaskets, various resins, inorganic paints and lacquer coating materials.

New types of highly effective sources and transformers of electrical energy have been developed. Fuel chemistry and the theory of combustion have undergone great development.

The creation of small computers, the improvement of remote control and control systems, the development of new methods of transmitting and processing information — these and many other aspects of technology have been stimulated by the requirements of astronautics and are now used in terrestrial devices, instruments, and equipment. The experience acquired by the designers of rocket and space technology finds wide application in machine building, aviation, and in transport.

Space investigations exerted a great influence on the development of biology and medicine. The number of problems advanced and solved by space medicine will greatly enhance the development of medical science.

The investigation of space has had a great influence on the education of people. Scientific and technical progress and success in the conquest of space have made science particularly attractive for youth. On the other hand, the use of artificial satellites of the Earth for educational purposes opens broad possibilities for significantly elevating all levels of education. Today great

projects for transmitting educational television programs over wide territories of the Earth exist and are being developed.

In the report of Corresponding Member of the Academy of Sciences of the USSR, O. Belotserkovskiy, "Space and Education", which was given at the Congress, there were questions of training cadres, using communications satellites for educational purposes. This report cited the data of specific space television systems, both existing and planned.

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One of the most important problems of modern astronautics is the creation of long-term orbital stations. In order to service them, special spacecraft are needed which are capable of making the Earth-orbit-Earth run many times. By their aid, one will be able to change crews that work at the stations, supply them with all they need, and deliver scientific equipment beyond the limits of the terrestrial atmosphere.

A two-day-long meeting of the section, "Problems of Space Transport" was devoted to a discussion of projects of such transport facilities.

An American specialist in this field, F. Calbertson stated, "The next very important stage in the development of astronautics is arriving, a stage in which basic work in conquering the Universe and studying it, as well as in investigating the Earth, will be undertaken by long-term orbital stations. We must design and create multiple-use spacecraft capable of being launched from the Earth, like rockets, and of returning from space, like aircraft. Then the cost of each kilogram of useful cargo delivered into orbit will become from 5 to 10 times cheaper."

F. Calbertson highly regarded the work of Pilot-Cosmonaut of the USSR, Candidate of Technical Sciences V. Shatalov and the group

of Soviet scientists who developed a method of controlling a spacecraft; this method is based on goniometric (optical) information. In the absence of navigational data usually obtained from the on-board measuring devices, this method ensures reliable guidance of the transport craft to the orbital station.

A discussion of the problems related to creating the space transport of the future showed that the combined efforts of the representatives of science and technology of different countries are useful and productive.

Supporting long-term manned spaceflights is a pressing problem of modern space biology and medicine.

"In order to solve this problem", said corresponding member of the Academy of Sciences of the USSR, O. Gazenko, "it is primarily necessary to organize correctly the immediate environment of man in space. In contrast to the Earth, where man has lived over thousands of years, in space we are called upon to create an artificial atmosphere, food, water supply, and to establish the necessary muscular load in a very brief period of time. An important place in flight is also occupied by man's psychological environment: the color of the spacecraft quarters, the organization of leisure and rest. In a word, during flight the cosmonauts should have at their disposal everything they have under terrestrial conditions. Science has identified these problems and is now developing each of them."

Soviet Pilot-Cosmonaut B. Yegorov considers the declaration of American scientists, based on the data of the "Skylab" station flight, that man can fly in space for an unlimited period of time, too categorical. In noting the success of his foreign colleagues, he still considers that medical and biological scientists do not as yet have adequate information at their disposal to make such

cardinal conclusions. In the opinion of B. Yegorov, the processes which occur in the cosmonaut's organism at the cellular level should become the object of a particularly careful investigation.

"We do not yet clearly understand what price the organism pays for its adaptation to weightlessness", he said.

Certain of the American specialists agreed with our cosmonaut. As evidence, they cited the work known to them of Soviet biologists, who have established physiological functions in certain animal cells dependent on the force of gravity. It was therefore hypothesized that during a long-term stay in space these functions could be disrupted.

The scheduled colloquium on space law was held within the framework of the Congress. Space law is a new branch of international law which is called upon to regulate the interrelationships between nations in the course of their conquest of space.

Commenting on the progress of the discussion, Dr. of Jurisprudence G. Zhukov, who chaired the colloquium, stated that today the solution to many problems in the field of the conquest of space, particularly problems related to international cooperation, depends on the regulation of political-legal problems. This pertains to the study of the natural resources of the Earth, the promise of conquering the Moon and other heavenly bodies, and direct television broadcasts by the aid of satellites. Therefore, the interest shown in these legal problems of space both within the framework of the United Nations and in scientific circles is entirely understandable.

International space law not only accompanies scientific-technical progress in the investigation and conquest of space, but also, in a number of cases, prepares a beachhead, as they say, for the

future activities of man in space. The foot of man had not stepped on the surface of the Moon when an agreement had been made that the Moon, all other heavenly bodies, and space itself as a whole would not be objects of acquisition. The time when man can proceed to practical activity on the Moon is not yet too near, but in the UN discussion is underway on a special pact concerning the Moon, and as a result the legal norms of the space pact of 1957 will be significantly fulfilled. One of the meetings of the colloquium was devoted to the problem of the legal status of orbital stations.

In citing the results of the work of the congress, Academician L. Sedoy^y stated, "In the varied mosaic of problems which confront science in the field of space study, the primary trends of investigations have been marked off. All of them are directly related to terrestrial affairs which are called upon to accomplish the tasks which will make possible reliable protection of the atmosphere, rational development and use of the natural resources of our planet. The first discussions at the Congress of problems related to creating transport facilities for multiple use, linking the Earth with stations sent into orbit, convincingly demonstrated that their solution is entirely realistic".

Translated for National Aeronautics and Space Administration under contract No. NASw 2483, by SCITRAN, P.O. Box 5456, Santa Barbara, California, 93108.